Zirconium element and graphene oxide in the construction and expansion of new catalysts

Majid Mosadegh[1] - Valiollah Mirkhani [2*]- Shakila Mohammadzade-Darshuri[3]

[1] M.Sc. in Inorganic Chemistry, Department of Inorganic Chemistry, Faculty of chemistry, University of Isfahan, Iran
[2*] professor of Inorganic Chemistry, Department of Inorganic Chemistry, Faculty of chemistry, University of Isfahan, Iran
[3] PhD student of Inorganic Chemistry, Department of Inorganic Chemistry, Faculty of chemistry, University of Isfahan, Iran

ABSTRACT

In recent years, many efforts have been made to achieve the principles of green chemistry. One of the important approaches is the development of heterogeneous catalysts. By studying the science of materials and identifying their physical and chemical properties and examining the appropriate context, the synthesis of efficient heterogeneous catalysts can be accessed. According to research and studies conducted in this experiment, intermediate metals such as Zirconium have become particularly important, due to their acidic properties, high thermal stability and low toxicity. Also, graphene oxide as a nanostructure with a high specific surface and having oxygenated functional groups is a suitable option for stabilizing metal species and improving catalytic performance.
According to extensive studies conducted from 1975 to 2025, an experiment was conducted to find and diagnose functional nano catalysts with high quality and efficiency. In this study, a new heterogeneous nano catalyst based on Zirconium chloride was synthesized on graphene oxide. The purpose of this study was to design efficient, sustainable and recyclable catalytic to perform selective oxidation reactions with high efficiency and selectivity. After synthesis, the structure and physicochemical properties of the catalyst and then its performance in the oxidation of the first and second types of alcohols to the corresponding carbonyl compounds, as well as the oxidation of sulphides to sulfoxides or sulfones were investigated using appropriate oxidizers and different methods.
The results of this study showed that this synthesized catalyst has high activity, short reaction time and desirable selectivity in the production of target products. Also, this catalyst can be recycled and reused by maintaining catalytic activity in several consecutive cycles. Of course, parameters such as temperature, catalyst amount and oxidizing ratio play an important role in its activity. Compared to conventional homogeneous catalysts, this system, in addition to reducing environmental pollution, also has an easier separation process. As a result, the heterogeneous catalyst of zirconium chloride stabilized on the graphene oxide substrate is a system with high potential for application in industrial processes and the development of green technologies.

Keywords: **Heterogenous catalysts, Zirconium, Green technologies, Graphene oxide**

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